

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-174305

(43)Date of publication of application : 09.07.1996

(51)Int.Cl.

B23B 19/02
F16C 35/078

(21)Application number : 06-324375

(71)Applicant : NTN CORP

(22)Date of filing : 27.12.1994

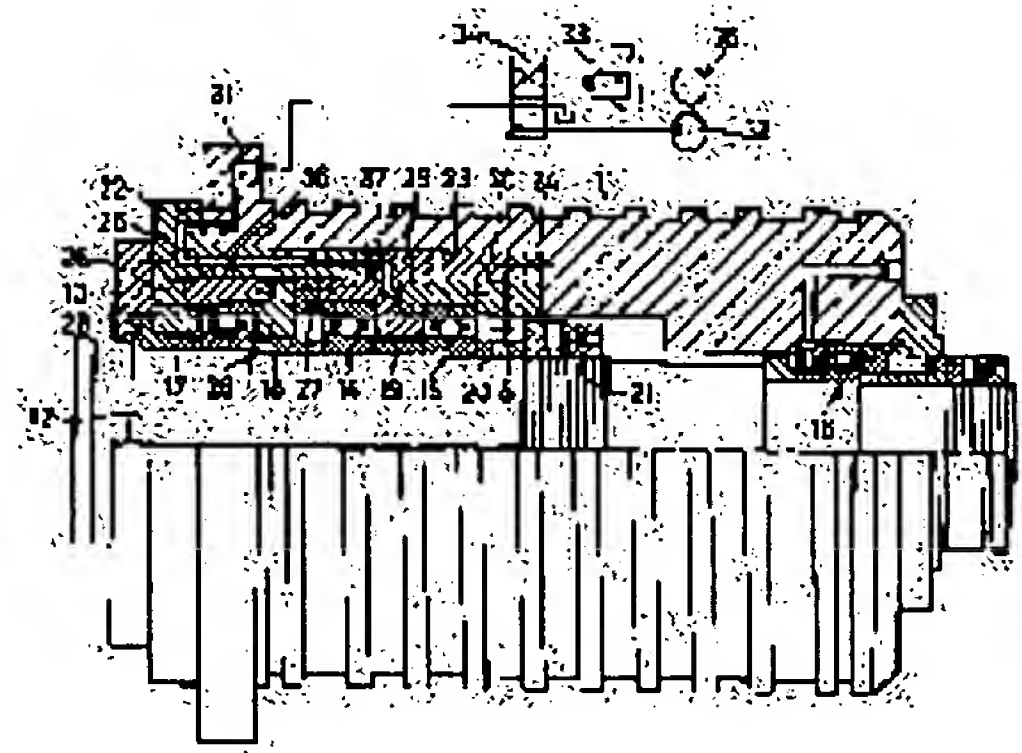
(72)Inventor : MORI MASATSUGU

(54) BEARING PRE-LOAD ADJUSTING MULTIPLE SPINDLE UNIT

(57)Abstract:

PURPOSE: To use in a wide rotation region from a low speed heavy cutting to a high speed light cutting in a single spindle unit.

CONSTITUTION: A spindle 12 running through a housing 11 is supported by a cylindrical roller bearing 13 and angular ball bearings 14, 15. Identical oil pressure is supplied to both bearings 13, 15 simultaneously, so that pre-preload adjusting of the cylindrical roller bearing 13 and the angular ball bearings is made at the same time.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's
decision of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The bearing precompression adjustment type spindle unit characterized by supporting a main shaft by the cylindrical roller bearing which an outer ring of spiral wound gasket is shrunk in the direction of a path by supply of a pressure flow object, and adjusts precompression, and the angular contact ball bearing which is made to move a bearing outer ring of spiral wound gasket to shaft orientations by supply of a pressure flow object, and changes axial clearance, enabling a free revolution, and supplying simultaneously the same pressure flow object for precompression adjustment to said cylindrical roller bearing and angular contact ball bearing.

[Translation done.]

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention enables simultaneously adjustment of the amount of precompression of cylindrical roller bearing and an angular contact ball bearing which supports the revolution main shaft of a machine tool, and relates to the high rigidity of a main shaft, and the bearing precompression adjustment type spindle unit which realized improvement in the speed.

[0002]

[Description of the Prior Art] Conventionally, let the spindle of a machine tool be a bearing structure of arrays as shown in drawing 2 in many cases in order to acquire the rigidity of a main shaft. That is, the angular contact ball bearing 4 which arranges the cylindrical roller bearing 3 which supports the load of a radial direction, adjoins it, and supports the load of the axial direction in the location by the side of an anti-work piece in the location by the side of the work piece of the main shaft 2 which penetrates the inside of housing 1 is arranged.

[0003] Each outer ring of spiral wound gasket is pushed on shaft orientations with the presser-foot lid 5, and each above-mentioned bearing 3 and 4 is being fixed to housing 1. Moreover, the cylindrical roller bearing 6 of size smaller than a work-piece side is arranged at the anti-work-piece side of a main shaft 2 in order to escape the bracing of a main shaft 2, and the thermal expansion of a main shaft 2.

[0004] Moreover, the precompression after the nest of each [these] bearing considers as 0 - negative clearance in cylindrical roller bearing 3 and 6, and is aiming at high rigidity-ization of a main shaft 2 as precompression in the angular contact ball bearing 4.

[0005] However, according to the above main shaft structures, at the time of inclusion, each bearing 3 and 4 is [both] in a precompression condition, and already becomes disadvantageous for improvement in the speed of a main shaft 2.

[0006] Where initial precompression of the bearing of such main shaft structure is enlarged, as an approach of accelerating a main shaft 2, the adjustable device of bearing precompression was needed, and for this reason, these people proposed the device which makes bearing precompression adjustable by the feeding and discarding of a pressure flow object by Japanese Patent Application No. No. 101039 [one to], and Japanese Patent Application No. No. 174018 [five to].

[0007]

[Problem(s) to be Solved by the Invention] By the way, the above-mentioned precompression adjustable device corresponds separately respectively to an angular contact ball bearing and cylindrical roller bearing, and as shown in drawing 2, there is a problem that control and a device become complicated and it cannot respond in the spindle structure where these two kinds of bearing 3 and 4 is arranged by the same main shaft 2.

[0008] Then, the technical problem of this invention applies the precompression change technique in which an angular contact ball bearing and cylindrical roller bearing are separate, and is to offer the bearing precompression adjustment type spindle unit which can perform simultaneously the precompression change of these two kinds of bearing.

[0009]

[Means for Solving the Problem] In order to solve the above technical problems, this invention is supported for a main shaft by the cylindrical roller bearing which an outer ring of spiral wound gasket is shrunk in the direction of a path by supply of a pressure flow object, and adjusts precompression, and the angular contact ball bearing which is made to move a bearing outer ring of spiral wound gasket to shaft orientations by supply of a pressure flow object, and changes axial clearance, enabling a free revolution, and adopts the configuration which supplied simultaneously the same pressure flow object for precompression adjustment to said cylindrical roller bearing and angular contact ball bearing.

[0010]

[Function] The precompression of both bearings can be simultaneously adjusted by carrying out the feeding and discarding of the same pressure flow object for precompression adjustment to the cylindrical roller bearing and the angular contact ball bearing which support a main shaft simultaneously, the low-speed high rigidity of a main shaft is acquired by the heavy precompression by supply of a pressure flow object, and it becomes ***** at the time of blowdown of a pressure flow object, and a high-speed revolution of a main shaft is obtained.

[0011]

[Example] Hereafter, the example of this invention is explained based on drawing 1 of an accompanying drawing.

[0012] In drawing 1, it is supported by two angular contact ball bearings 14 and 15 to which the main shaft 12 which penetrates the inside of housing 11 to shaft orientations is supported by the cylindrical roller bearing 13 to which the location by the side of a work piece supports the load of a radial direction, it is adjoined and the location by the side of an anti-work piece supports the load of the axial direction, and the edge by the side of an anti-work piece is further supported by cylindrical roller bearing 16.

[0013] With the spacers 17, 18, 19, and 20 attached outside a main shaft 12, and the nut 21 fixed to the main shaft 12, each inner ring of spiral wound gasket of the above-mentioned cylindrical roller bearing 13 and angular contact ball bearings 14 and 15 is being fixed to the main shaft 12, after having been positioned by shaft orientations.

[0014] Sequential insertion of an outer case 22, a retaining ring 23, and the locating ring 24 is carried out from a work-piece side at order, inside said housing 11, with the outer case 22 which carried out bolt immobilization, a retaining ring 23 and a locating ring 24 are pushed on shaft orientations, and it fixes to housing 11, and cylindrical roller bearing 13 is incorporated between a main shaft 12 and an outer case 22, and angular contact ball bearings 14 and 15 are located between a main shaft 12 and a retaining ring 23.

[0015] Positioning of shaft orientations is made with the lid 28 in which cylindrical roller bearing 13 carried out bolt ** at the lid 27 and outer case 22 which the outer-diameter side of the spacers 26 and 26 and this ring 25 which the outer ring of spiral wound gasket fitted into the bore of the pressure adjustment ring 25 beforehand, and were inserted in the both-sides end-face section of an outer ring of spiral wound gasket fitted in in the outer case 22, and were made to intervene between retaining rings 23.

[0016] Beforehand, the pressure adjustment ring 25 is formed using the ingredient which can be contracted, and when the condition that an outer-diameter side contacts the bore side of an outer case 22 serves as ***** of cylindrical roller bearing 13 and contacts the shoulder of spacers 26 and 26 at the time of contraction, the amount of heavy precompression is set up.

[0017] An outer ring of spiral wound gasket fits in directly in a retaining ring 23, and one angular contact ball bearing 14 is fixed by the retaining ring 23 at shaft orientations with the lid 27 which carried out bolt **.

[0018] An outer ring of spiral wound gasket fits in in the pressure adjustment sleeve 29 beforehand, and the angular contact ball bearing 15 of another side is being fixed so that 1 body motion may be carried out to this sleeve 29 at a sleeve 29 with the lid 30 which carried out bolt **.

[0019] It fits in so that the pressure adjustment sleeve 29 and the lid 30 fixed to this may become movable to shaft orientations about the inside of a retaining ring 23 beforehand, and between the

locating rings 24 and lids 30 which carried out bolt ** at the retaining ring 23, clearance delta is formed considerable the bottom beforehand at the pressure adjustment.

[0020] In order to perform precompression adjustment of said cylindrical roller bearing 13 and angular contact ball bearings 14 and 15, The oil pressure path 31 is formed in housing 11, an outer case 22, and a retaining ring 23 in the shape of a free passage. The hydraulic power unit 35 which becomes the housing 11 side-edge section of this path 31 from a pump 32, a pressure control valve 33, and a directional selecting valve 34 is connected. It is made to face so that opening may be beforehand carried out to the outer-diameter side of the pressure adjustment ring 25 by making the middle of the outer case part of this path 31 into the cylindrical-roller-bearing section 36, and the edge located in the part of a retaining ring 23 is made into the angular contact ball bearing section 37, and it carries out opening so that the end face of the pressure adjustment sleeve 29 may be attended beforehand.

[0021] Therefore, precompression adjustment of cylindrical roller bearing 13 and angular contact ball bearings 14 and 15 can use the same hydraulic power unit and the same oil pressure, and can be performed simultaneously.

[0022] The spindle units of this invention are the above configurations, and beforehand, by cylindrical roller bearing 13, a pressure adjustment is shrinking an outer ring of spiral wound gasket in the direction of a path, and changing a radial crevice, and is performed at angular contact ball bearings 14 and 15 by moving the outer ring of spiral wound gasket of bearing 15 to shaft orientations, and changing axial clearance.

[0023] If the high voltage oil generated in the hydraulic power unit 35 is supplied to the cylindrical-roller-bearing section 36 and the angular contact ball bearing section 37 through the oil pressure path 31, in cylindrical roller bearing 13, the oil pressure beforehand supplied to the outer-diameter side of the pressure adjustment ring 25 will shrink this ring 25 and outer ring of spiral wound gasket, and will make a radial clearance small.

[0024] In an angular contact ball bearing 15, the oil pressure beforehand supplied to the end face of the pressure adjustment sleeve 29 moves this sleeve 29 and an outer ring of spiral wound gasket to the shaft orientations on the right-hand side of drawing 1 , and makes small the axial clearance between angular contact ball bearings 14 and 15.

[0025] Thus, if oil pressure is supplied, both cylindrical roller bearing 13 and the angular contact ball bearings 14 and 15 serve as clearance smallness (heavy precompression), and correspond to low-speed high rigidity operation of a main shaft 12.

[0026] On the other hand, when there is no supply of oil pressure, clearance becomes large (*****) and both cylindrical roller bearing 13 and the angular contact ball bearing 15 are fit for a high-speed revolution of a main shaft 12. In addition, what is necessary is just to perform turning on and off of this hydraulic pressure supply by operating a directional selecting valve 34 with the signal of a main shaft rotational frequency.

[0027]

[Effect of the Invention] As mentioned above, according to this invention, can perform simultaneously precompression adjustment of cylindrical roller bearing and an angular contact ball bearing which supports a main shaft, and the high rigidity of a revolution main shaft and improvement in the speed are attained, consequently high-speed light cutting processing is attained from low-speed deep cuts with one spindle unit, and it can be used in a broad revolution field.

[Translation done.]

(19)日本国特許庁 (J P)

(12) 公 開 特 許 公 報 (A)

(11)特許出願公開番号

特開平8-174305

(43)公開日 平成8年(1996)7月9日

(51)Int.Cl.⁶

識別記号

庁内整理番号

F I

技術表示箇所

B 2 3 B 19/02

B

F 1 6 C 35/078

審査請求 未請求 請求項の数1 O L (全 4 頁)

(21)出願番号 特願平6-324375

(22)出願日 平成6年(1994)12月27日

(71)出願人 000102692

エヌティエヌ株式会社

大阪府大阪市西区京町堀1丁目3番17号

(72)発明者 森 正継

四日市市西大鐘町468番地

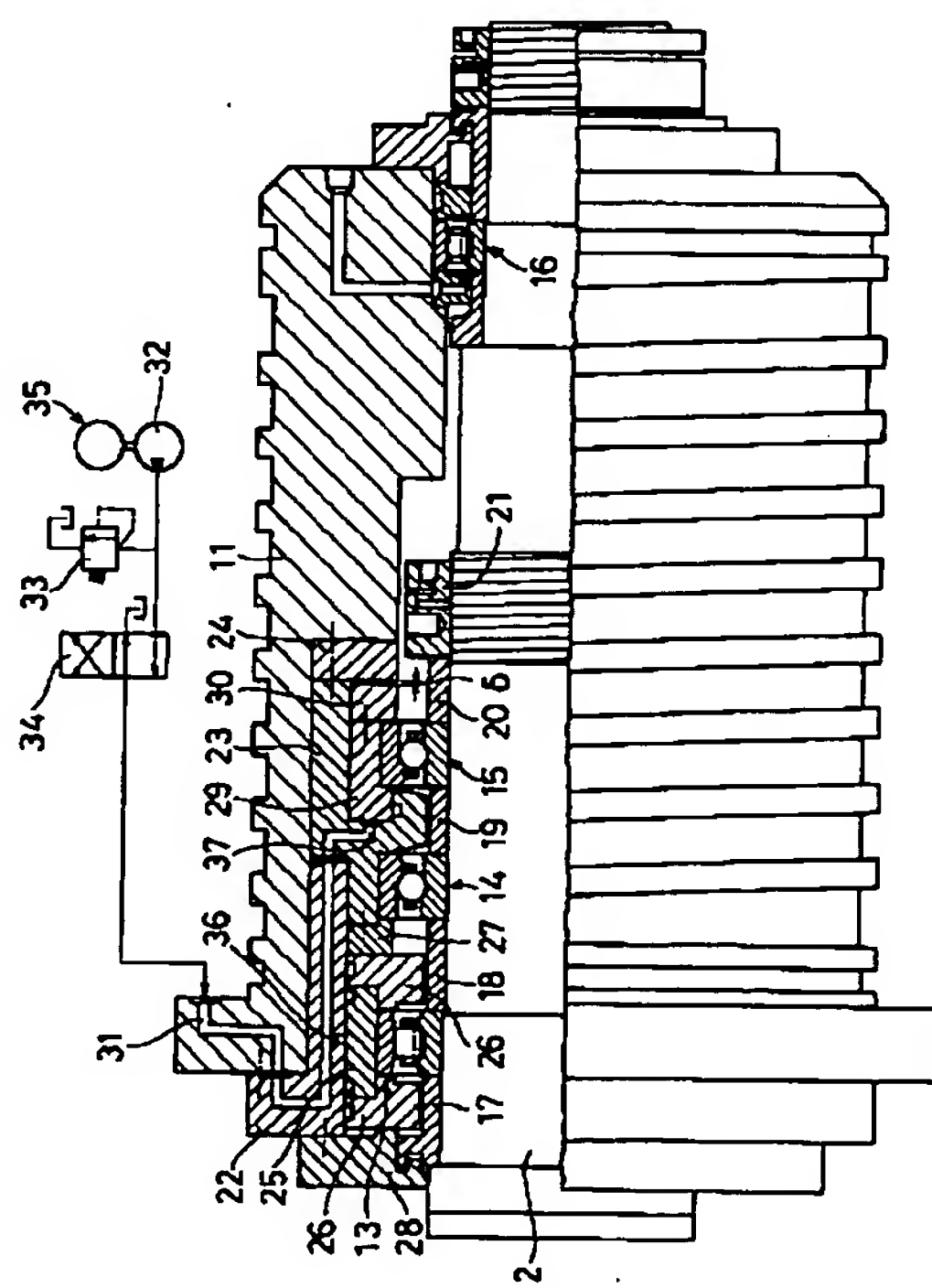
(74)代理人 弁理士 鎌田 文二 (外2名)

(54)【発明の名称】 軸受予圧調整式主軸ユニット

(57)【要約】

【目的】 一本の主軸ユニットで、低速重切削から高速軽切削加工が可能となり、幅広い回転領域で使用できるようにする。

【構成】 ハウジング11を貫通する主軸12を円筒ころ軸受13とアンギュラ玉軸受14、15で支持し、両軸受13、15に同一の油圧を同時に供給することにより、円筒ころ軸受13とアンギュラ玉軸受14、15の予圧調整を同時に行なうことができる。



【特許請求の範囲】

【請求項1】 圧力流体の供給で外輪を径方向に収縮させて予圧を調整する円筒ころ軸受と、圧力流体の供給により軸受外輪を軸方向に移動させてアキシャルすきまを変えるアンギュラ玉軸受とで主軸を回転自在に支持し、前記円筒ころ軸受とアンギュラ玉軸受とに、同一の予圧調整用圧力流体を、同時に供給するようにしたことを特徴とする軸受予圧調整式主軸ユニット。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は、工作機械の回転主軸を支持する円筒ころ軸受とアンギュラ玉軸受の予圧量を同時に調整可能とし、主軸の高剛性と高速化を実現した軸受予圧調整式主軸ユニットに関する。

【0002】

【従来の技術】従来、工作機械のスピンデルは、主軸の剛性を得るため、図2に示すような軸受配列の構造とする場合が多い。即ち、ハウジング1内を貫通する主軸2のワーク側の位置に、ラジアル方向の負荷を支持する円筒ころ軸受3を配置し、それに隣接して反ワーク側の位置にアキシャル方向の負荷を支持するアンギュラ玉軸受4が配置される。

【0003】上記各軸受3、4は、各々の外輪が押え蓋5により軸方向に押されてハウジング1に固定されている。また、主軸2の反ワーク側には、主軸2の振れ止めと主軸2の熱膨張を逃げる目的で、ワーク側より小さなサイズの円筒ころ軸受6が配置される。

【0004】また、これら各軸受の組込み後の予圧は、円筒ころ軸受3、6では0～負すきまとし、アンギュラ玉軸受4では予圧として、主軸2の高剛性化を狙っている。

【0005】しかし、上記のような主軸構造によると、組込時において、すでに各軸受3、4が共に予圧状態にあり、主軸2の高速化には不利になる。

【0006】このような主軸構造の軸受の初期予圧を大きくした状態で、主軸2を高速化する方法としては、軸受予圧の可変機構が必要となり、このため、本出願人は、特願平1-101039号及び特願平5-174018号により、圧力流体の給排で軸受予圧を可変とする機構を提案した。

【0007】

【発明が解決しようとする課題】ところで、上記した予圧可変機構は、アンギュラ玉軸受と円筒ころ軸受に対して各々別個に対応したものであり、図2に示したように、これら2種類の軸受3、4が同一の主軸2に配列されるスピンデル構造には、制御や機構が複雑となって対応できないという問題がある。

【0008】そこで、この発明の課題は、アンギュラ玉軸受と円筒ころ軸受の別個の予圧切換え技術を応用し、これら2種類の軸受の予圧切換えを同時に行なえる軸受

予圧調整式主軸ユニットを提供することにある。

【0009】

【課題を解決するための手段】上記のような課題を解決するため、この発明は、圧力流体の供給で外輪を径方向に収縮させて予圧を調整する円筒ころ軸受と、圧力流体の供給により軸受外輪を軸方向に移動させてアキシャルすきまを変えるアンギュラ玉軸受とで主軸を回転自在に支持し、前記円筒ころ軸受とアンギュラ玉軸受とに、同一の予圧調整用圧力流体を、同時に供給するようにした構成を採用したものである。

【0010】

【作用】主軸を支持する円筒ころ軸受とアンギュラ玉軸受とに、同一の予圧調整用圧力流体を同時に給排することで、両軸受の予圧を同時に調整することができ、圧力流体の供給による重予圧で主軸の低速高剛性が得られ、また、圧力流体の排出時は軽予圧となり、主軸の高速回転が得られる。

【0011】

【実施例】以下、この発明の実施例を添付図面の図1に基づいて説明する。

【0012】図1において、ハウジング11内を軸方向に貫通する主軸12は、ワーク側の位置がラジアル方向の負荷を支持する円筒ころ軸受13で支持され、それに隣接して反ワーク側の位置が、アキシャル方向の負荷を支持する2個のアンギュラ玉軸受14、15によって支持され、更に反ワーク側の端部が円筒ころ軸受16で支持されている。

【0013】上記円筒ころ軸受13とアンギュラ玉軸受14、15の各内輪は、主軸12に外嵌する間座17、18、19、20と、主軸12に固定したナット21により、軸方向に位置決めされた状態で主軸12に固定されている。

【0014】前記ハウジング11の内部に、ワーク側から順に、外筒22と支持リング23及び位置決めリング24が順次挿入され、ハウジング11にボルト固定した外筒22で支持リング23と位置決めリング24を軸方向に押して固定し、円筒ころ軸受13は、主軸12と外筒22の間に組込まれ、アンギュラ玉軸受14、15は、主軸12と支持リング23の間に位置している。

【0015】円筒ころ軸受13は、外輪が予圧調整リング25の内径に嵌合し、外輪の両側端面部に挿入した間座26、26と該リング25の外径面は外筒22内に嵌合し、支持リング23との間に介在させた蓋27及び外筒22にボルト止した蓋28により、軸方向の位置決めがなされている。

【0016】予圧調整リング25は、収縮可能な材料を用いて形成され、外径面が外筒22の内径面に当接する状態が円筒ころ軸受13の軽予圧となり、収縮時に間座26、26の肩部に当接することにより重予圧量が設定される。

3

【0017】一方のアンギュラ玉軸受14は、外輪が支持リング23内に直接嵌合し、支持リング23にボルト止した蓋27で軸方向に固定化されている。

【0018】他方のアンギュラ玉軸受15は、外輪が予圧調整スリーブ29内に嵌合し、該スリーブ29にボルト止した蓋30でスリーブ29に一体動するよう固定されている。

【0019】予圧調整スリーブ29と、これに固定した蓋30は、支持リング23内を軸方向に移動可能となるよう嵌合し、支持リング23にボルト止した位置決めリング24と蓋30との間には、予圧調整に相当したすきま δ が設けられている。

【0020】前記円筒ころ軸受13及びアンギュラ玉軸受14、15の予圧調整を行なうため、ハウジング11と外筒22及び支持リング23に油圧経路31を連通状に設け、該経路31のハウジング11側端部に、ポンプ32と圧力制御弁33及び方向切換弁34からなる油圧源35を接続し、該経路31の外筒部分の途中を円筒ころ軸受部36として予圧調整リング25の外径面に開口するよう臨ませ、支持リング23の部分に位置する端部はアンギュラ玉軸受部37とし、予圧調整スリーブ29の端面に臨むよう開口させている。

【0021】従って、円筒ころ軸受13とアンギュラ玉軸受14、15の予圧調整は、同一の油圧源及び同一の油圧を使用し、同時に行なうことができる。

【0022】この発明の主軸ユニットは上記のような構成であり、予圧調整は、円筒ころ軸受13では、外輪を径方向に収縮させ、ラジアルすき間を変えることで、アンギュラ玉軸受14、15では軸受15の外輪を軸方向に移動させてアキシャルすき間を変えることで行なう。

【0023】油圧源35で発生した高圧油を、油圧経路31を経て円筒ころ軸受部36とアンギュラ玉軸受部37に供給すると、円筒ころ軸受13では、予圧調整リング25の外径面に供給された油圧が、このリング25と

4

外輪を収縮させ、ラジアルすき間を小さくする。

【0024】アンギュラ玉軸受15では、予圧調整スリーブ29の端面に供給された油圧が、該スリーブ29と外輪を図1右側の軸方向に移動させ、アンギュラ玉軸受14、15のアキシャルすき間を小さくする。

【0025】このように、油圧を供給すると、円筒ころ軸受13とアンギュラ玉軸受14、15は共にすきま小（重予圧）となり、主軸12の低速高剛性運転に対応する。

【0026】一方、油圧の供給がない場合は、円筒ころ軸受13とアンギュラ玉軸受15は、共にすきまが大きく（軽予圧）なって、主軸12の高速回転に向く。なお、この油圧供給のオン・オフは、主軸回転数の信号により、方向切換弁34を作動させて行なえばよい。

【0027】

【発明の効果】以上のように、この発明によると、主軸を支持する円筒ころ軸受とアンギュラ玉軸受の予圧調整を同時に行なうことができ、回転主軸の高剛性と高速化が可能になり、この結果、一本の主軸ユニットで、低速重切削から高速軽切削加工が可能となり、幅広い回転領域で使用できる。

【図面の簡単な説明】

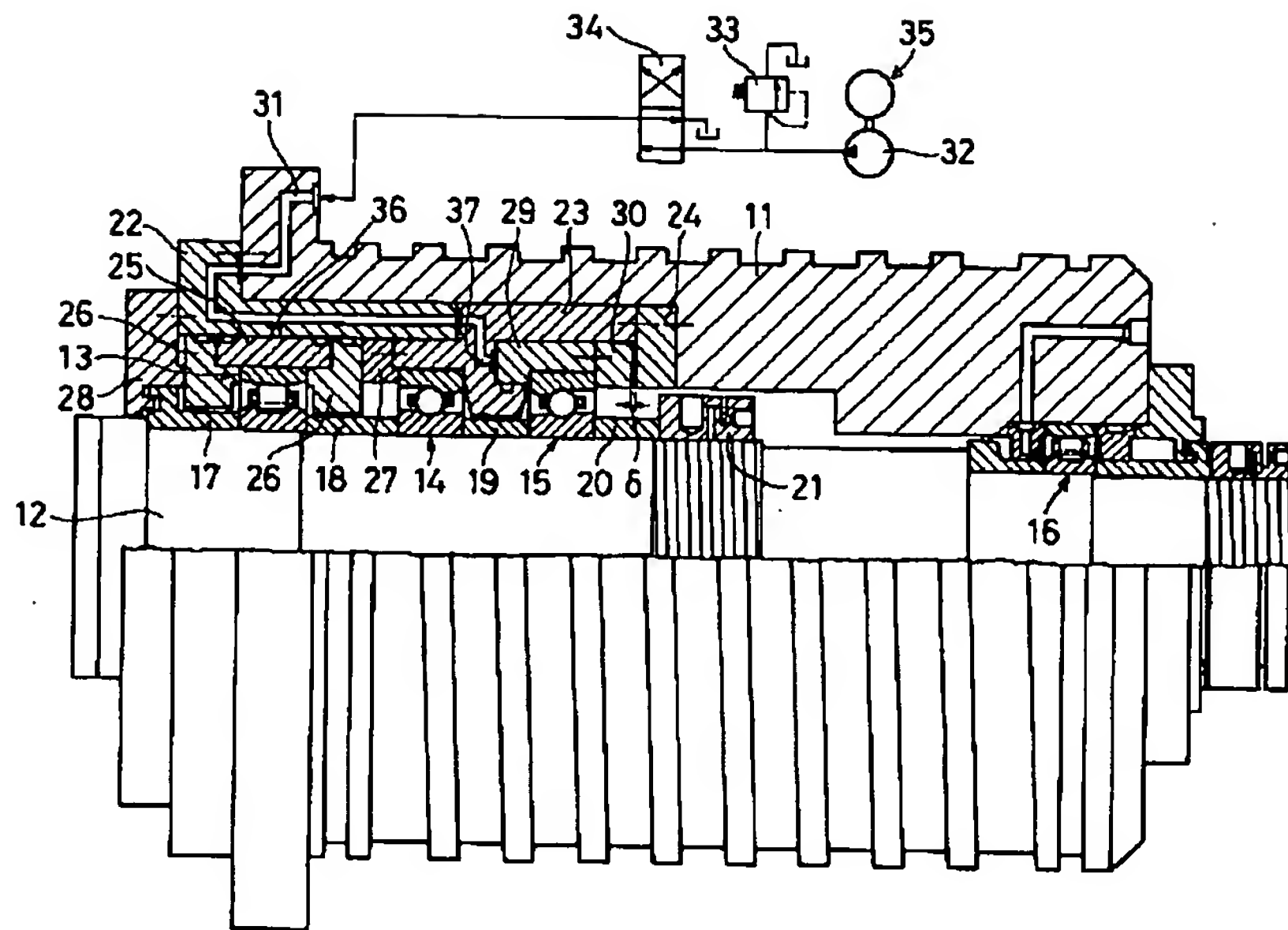
【図1】この発明の軸受予圧調整式主軸ユニットを示す一部切欠正面図

【図2】従来の主軸ユニットを示す一部切欠正面図

【符号の説明】

- 11 ハウジング
- 12 主軸
- 13 円筒ころ軸受
- 14、15 アンギュラ玉軸受
- 25 予圧調整リング
- 29 予圧調整スリーブ
- 31 油圧経路

【図1】



【図2】

